VLANs, Trunking and VTP

Cabrillo College

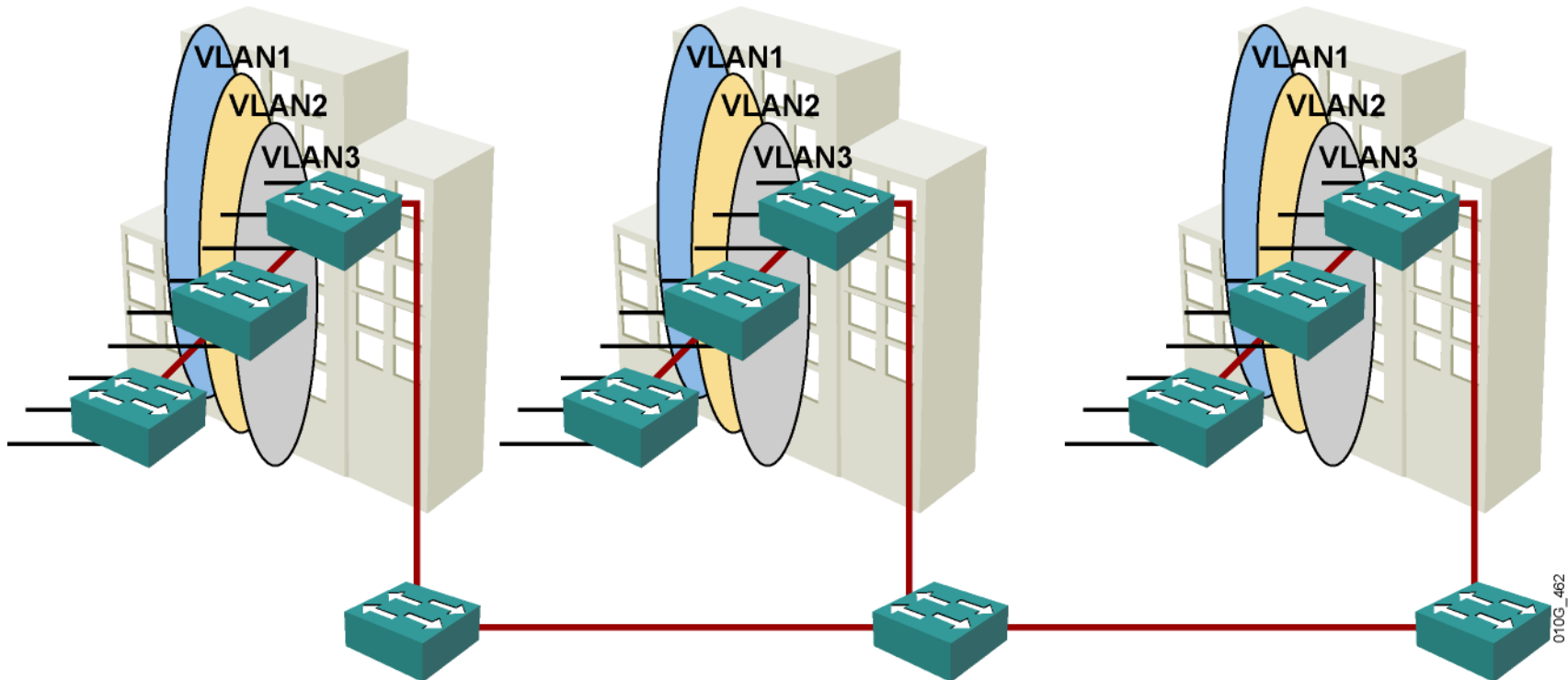CIS 187 Multilayer Switched Networks

CCNP 3 version 4

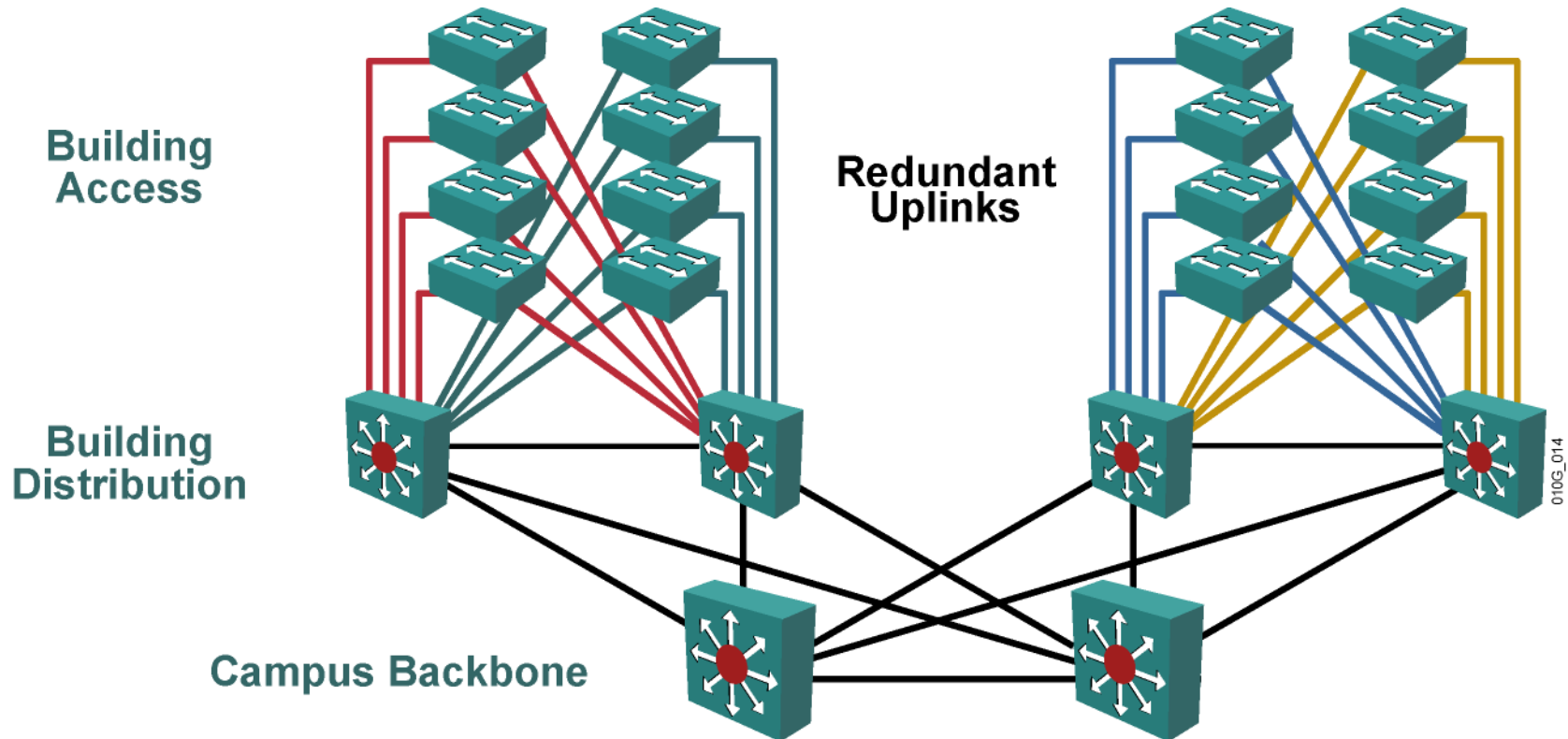Rick Graziani

Fall 2006

Review VLANs, Trunking and VTP

- If you need a more thorough review of VLANs, Trunking and VTP, refer to material in CIS 83 (CCNA 3).

- In this review we will use that Lab:

  VLANs, Trunking and VTP (NetLab)
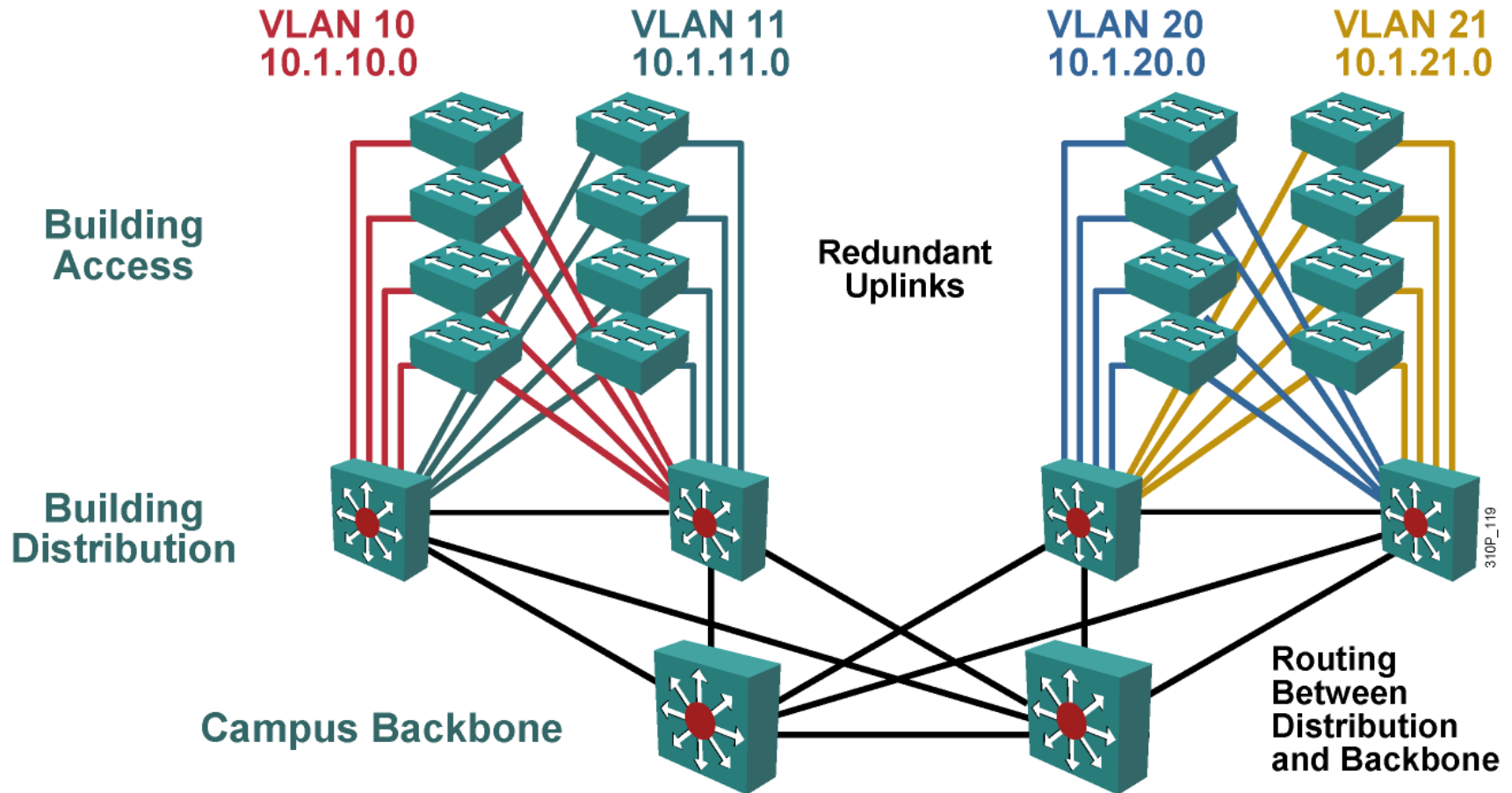
What Is an End-to-End VLAN?

- – Users are grouped into VLANs independent of physical location.
- – If users are moved within the campus, their VLAN membership remains the same.

What Is a Local VLAN?

Building Access

Redundant Uplinks

Building Distribution

Campus Backbone

010G_014

- Local VLANs are generally confined to a wiring closet.

VLANs and the Logical Network

VLAN 10
10.1.10.0

VLAN 11
10.1.11.0

VLAN 20
10.1.20.0

VLAN 21
10.1.21.0

Building Access

Redundant Uplinks

Building Distribution

Campus Backbone

Routing Between Distribution and Backbone

310P_119

End-to-End or Campus-wide VLANs

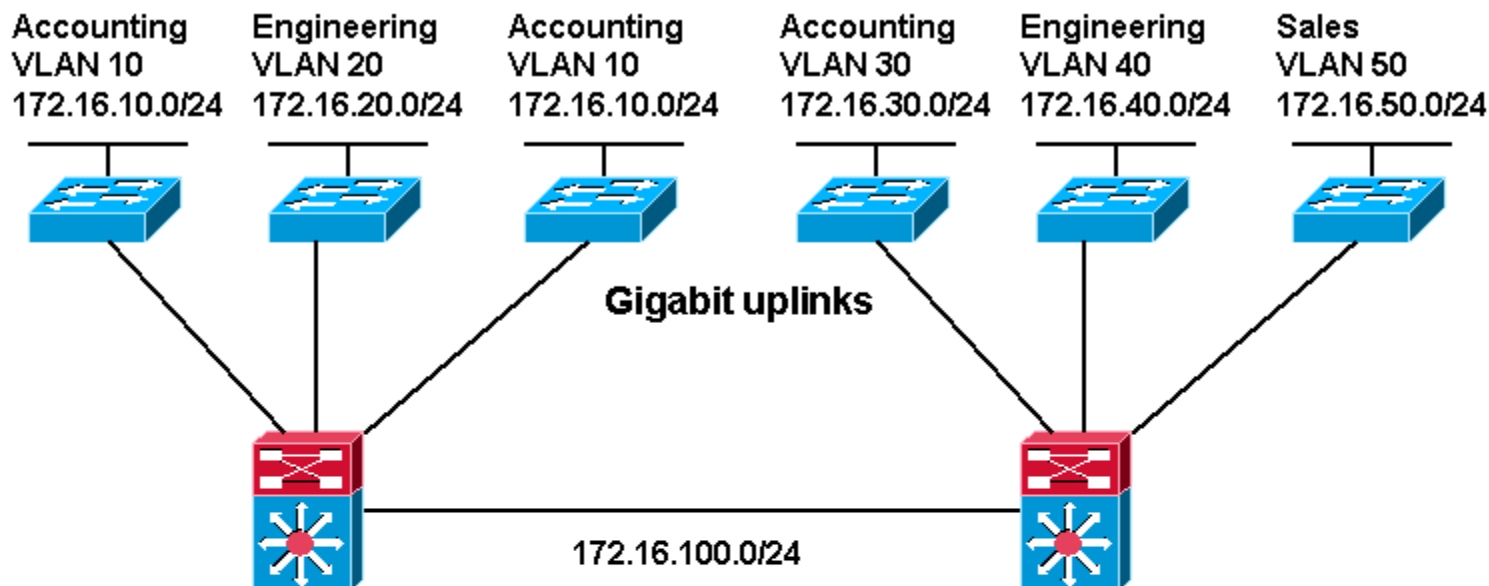| Accounting VLAN 10 172.16.10.0/24 | Engineering VLAN 20 172.16.20.0/24 | Accounting VLAN 10 172.16.10.0/24 | Accounting VLAN 10 172.16.10.0/24 | Engineering VLAN 20 172.16.20.0/24 | Sales VLAN 30 172.16.30.0/24 |

Gigabit uplinks

VLAN Trunk
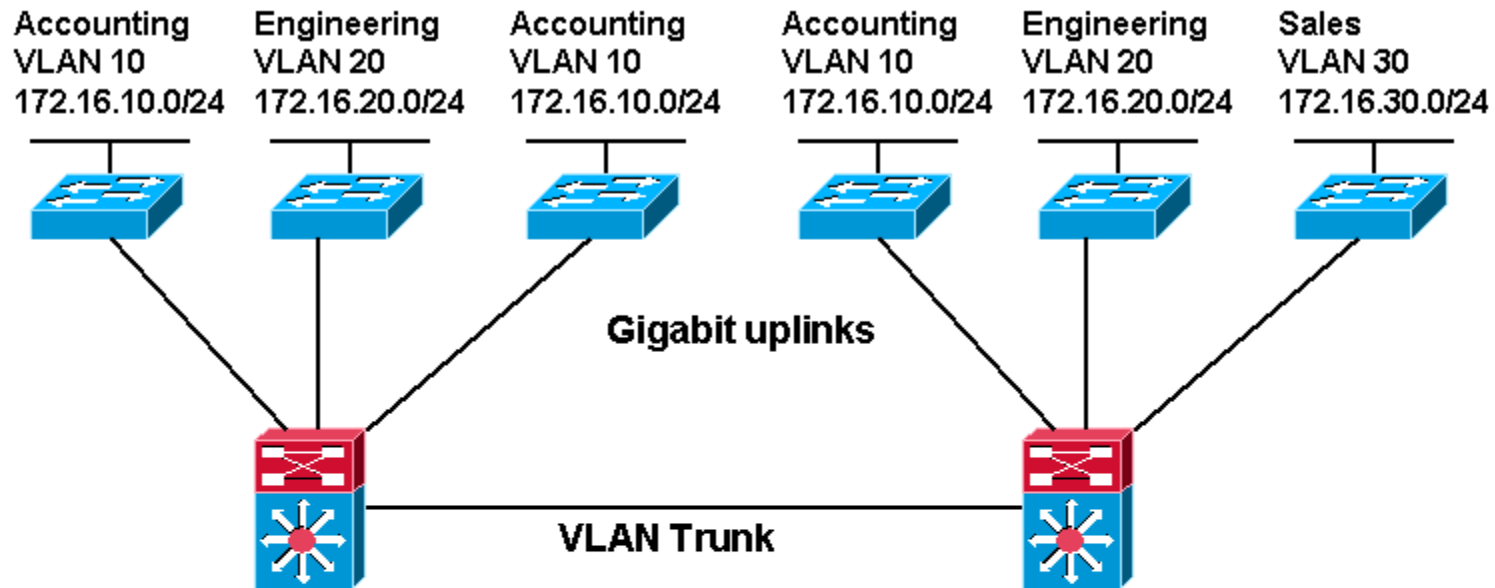
Campus-wide or End-to-End VLAN Model

• VLANs based on functionality

• "VLAN everywhere" model

• VLANs with the same VLAN ID, I.e. Accounting VLAN 10, can be anywhere in the network
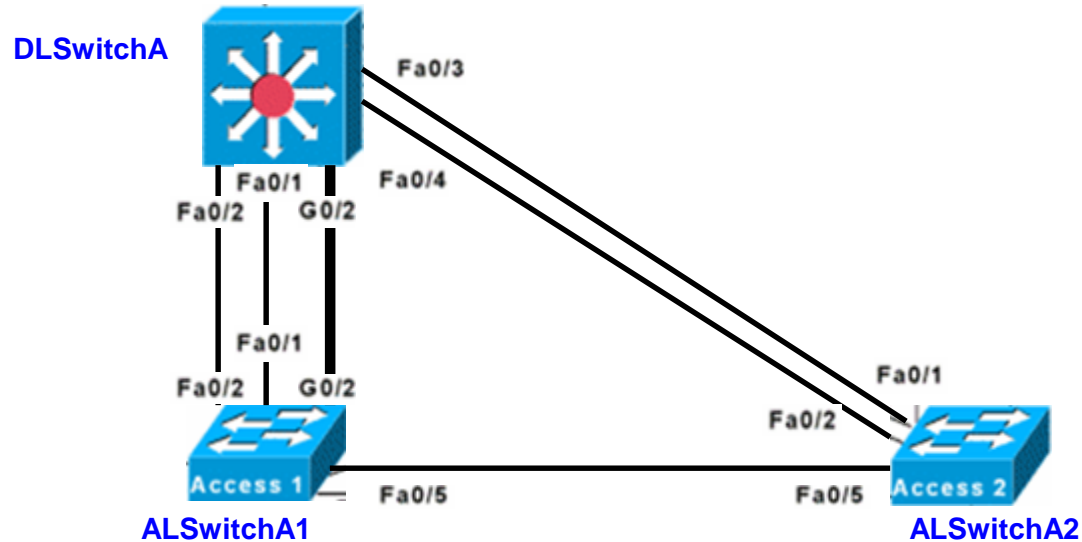
Geographic or Local VLANs

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Accounting	Engineering	Accounting	Accounting	Engineering	Sales
VLAN 10	VLAN 20	VLAN 10	VLAN 30	VLAN 40	VLAN 50
172.16.10.0/24	172.16.20.0/24	172.16.10.0/24	172.16.30.0/24	172.16.40.0/24	172.16.50.0/24

Gigabit uplinks

172.16.100.0/24

Local or Geographic VLAN Model

• VLANs based on physical location

• VLANs dedicated to each access layer switch cluster

• Accounting users connected to different layer 3 switches are on different VLANs, I.e. Accounting VLAN 10 and VLAN 30

Topology

DLSwitchA

Fa0/3

Fa0/1
Fa0/2   G0/2   Fa0/4

Fa0/1

Fa0/2   G0/2   Fa0/1

Fa0/2

Access 1

ALSwitchA1   Fa0/5   Fa0/5   Access 2   ALSwitchA2

- Basic Switch Configuration
- Configure VLANs
- Configure Trunking
- Configure VTP

Basic Configuration

```
Switch#config terminal
Switch(config)#hostname DLSwitchA
DLSwitchA(config)#line con 0
DLSwitchA(config-line)#logging synchronous
DLSwitchA(config-line)#exec-timeout 0 0
DLSwitchA(config-line)#interface vlan 1
DLSwitchA(config-if)#ip address 10.1.1.250 255.255.255.0
DLSwitchA(config-if)#no shutdown
```

- To allow the switch to be accessible by Telnet and other TCP/IP applications, IP addresses and a default gateway should be set.
- By default, VLAN 1 is the management VLAN.
- **logging synchronous** command keeps terminal output from interfering with terminal input.
- **exec-timeout 0 0** command keeps the switch from timing out of privileged mode.

Verify neighbors

```
DLSwitchA#show cdp neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater
Device ID          Local Intrfce      Holdtme    Capability  Platform  Port ID
Switch             Gig 0/1              137          S I      WS-C3550-4Gig 0/1
Switch             Fas 0/5              127          S I      WS-C3550-2Fas 0/5
ALSwitchA2         Fas 0/4              147          S I      WS-C2950-2Fas 0/2
ALSwitchA2         Fas 0/3              147          S I      WS-C2950-2Fas 0/1
ALSwitchA1         Gig 0/2              141          S I      WS-C2950T-Gig 0/2
ALSwitchA1         Fas 0/2              141          S I      WS-C2950T-Fas 0/2
ALSwitchA1         Fas 0/1              141          S I      WS-C2950T-Fas 0/1
```

Spanning Tree Protocol

```
DLSwitchA#show spanning-tree
<Output omitted>
Interface         Port ID                        Designated                          Port ID
Name              Prio.Nbr    Cost Sts           Cost Bridge ID                      Prio.Nbr
----------------- -------- --------- ---     --------- -------------------- --------
Fa0/1             128.1          19 BLK          19 32769 000b.befa.eec0 128.1
Fa0/2             128.2          19 BLK          19 32769 000b.befa.eec0 128.2
Fa0/3             128.3          19 FWD           0 32769 0009.7c0b.e7c0 128.1
Fa0/4             128.4          19 BLK           0 32769 0009.7c0b.e7c0 128.2
Fa0/5             128.5          19 FWD          19 32769 000b.fd13.9080 128.5
Gi0/1             128.25          4 FWD          19 32769 000b.fd13.9080 128.25

Interface         Port ID                        Designated                          Port ID
Name              Prio.Nbr    Cost Sts           Cost Bridge ID                      Prio.Nbr
----------------- -------- --------- ---     --------- -------------------- --------
Gi0/2             128.26          4 BLK          19 32769 000b.befa.eec0 128.26
```
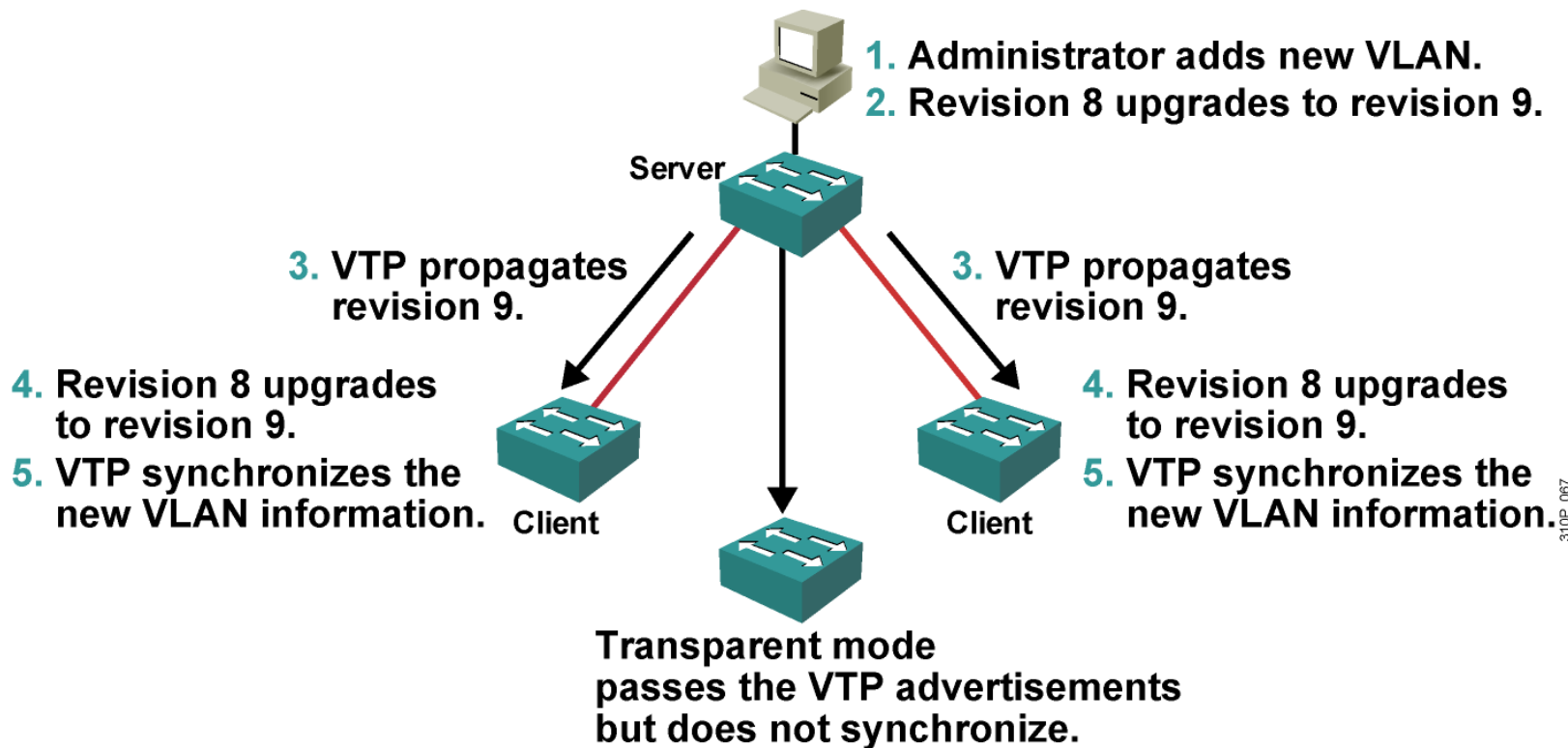
- Although multiple connections are displayed between switches, not all ports are in Spanning Tree Protocol (STP) forwarding state.

- By default, STP creates only one forwarding path between switches starting from the Root Switch.

- This will be discussed in more detail during the STP labs.

VTP Review

- VTP (VLAN Trunking Protocol) is used to distribute and synchronize information about VLANs that are configured throughout a switched network.

- Switches transmit VTP messages only on 802.1Q and ISL trunks.

- **Note**: VTP is not required to configure trunking between switches, but is used to simplify VLAN management.

- **VTP Server**
  – This has a default VTP mode. VLANs can be created, modified, and deleted.

- **VTP Client**
  – This behaves like a VTP server without the ability to create, change, or delete VLANs.

- **VTP Transparent**
 – Switches in the VTP Transparent mode do not participate in VTP.

VTP Operation

- **VTP advertisements are sent as multicast frames.**
- **VTP servers and clients are synchronized to the latest revision number.**
- **VTP advertisements are sent every 5 minutes or when there is a change.**

1. Administrator adds new VLAN.
2. Revision 8 upgrades to revision 9.

Server

3. VTP propagates revision 9.

3. VTP propagates revision 9.

4. Revision 8 upgrades to revision 9.
5. VTP synchronizes the new VLAN information.

Client

4. Revision 8 upgrades to revision 9.
5. VTP synchronizes the new VLAN information.

Client

Transparent mode passes the VTP advertisements but does not synchronize.

310P_067

VTP Pruning

- Uses bandwidth more efficiently by reducing unnecessary flooded traffic
- Example: Station A sends broadcast; broadcast flooded only toward any switch with ports assigned to the red VLAN
- `Switch(config)# ` **`vtp pruning`**

Pruning Disabled   **Pruning Enabled**
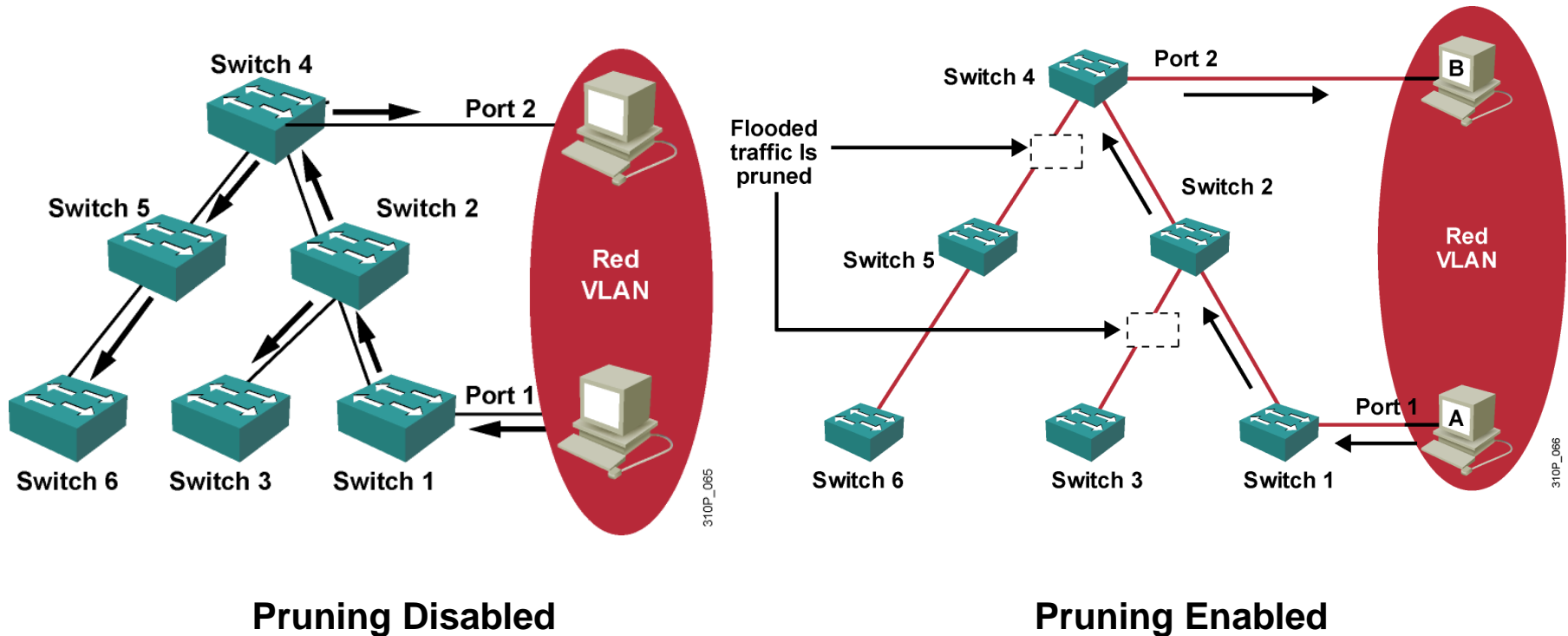
Adding a Switch to an Existing VTP Domain
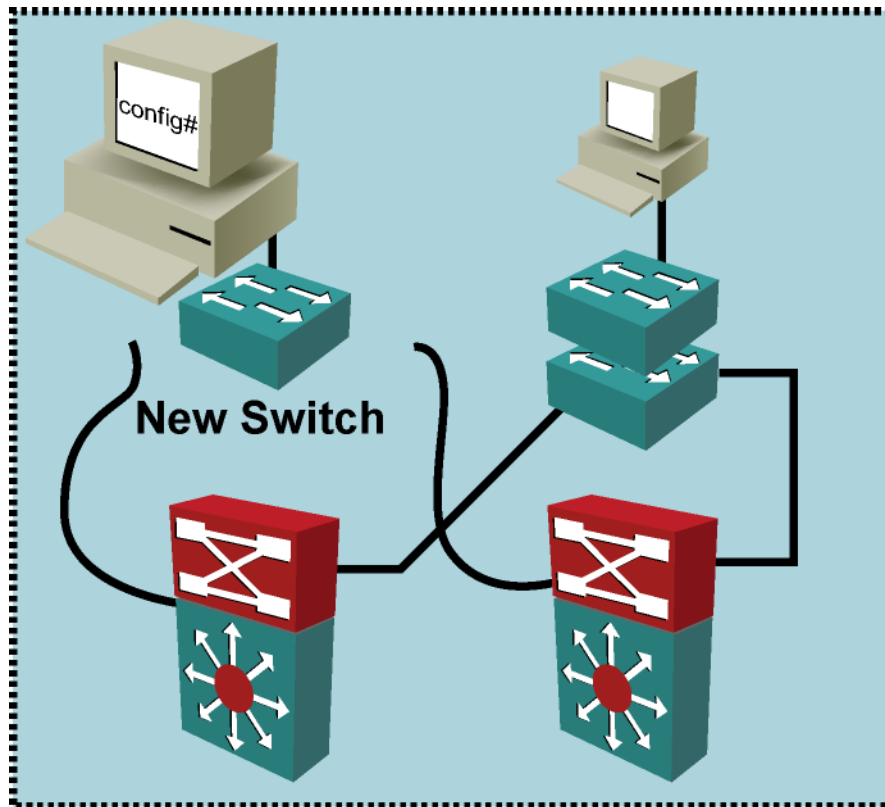
Ensure a new switch has VTP revision 0 before adding it to a network.

Reviewing VTP

```
DLSwitchA#show vtp status
VTP Version                    : 2
Configuration Revision         : 0
Maximum VLANs supported locally : 1005
Number of existing VLANs       : 5
VTP Operating Mode             : Server
VTP Domain Name                :
VTP Pruning Mode               : Disabled
VTP V2 Mode                    : Disabled
VTP Traps Generation           : Disabled
MD5 digest                     : 0xB7 0x5D 0xB6 0x6D 0xE0 0xC0 0x3E 0x2E
Configuration last modified by 0.0.0.0 at 0-0-00 00:00:00
Local updater ID is 10.1.1.250 on interface Vl1 (lowest numbered VLAN
   interface found)
```

- Since no VLAN configurations were made, all settings will be the defaults. Notice the VTP mode is **Server**.

- The number of existing VLANs is the five built-in (reserved) VLANs.
  - VLAN 1, 1002, 1003, 1004, 1005

Configuring VTP

```
DLSwitchA(config)#vtp domain CORP
Changing VTP domain name from NULL to CORP


DLSwitchA#show vtp status
VTP Version                        : 2
Configuration Revision             : 0
Maximum VLANs supported locally : 1005
Number of existing VLANs           : 5
VTP Operating Mode                 : Server
VTP Domain Name                    : CORP


ALSwitchA1#show vtp status
VTP Version                        : 2
Configuration Revision             : 0
Maximum VLANs supported locally : 250
Number of existing VLANs           : 5
VTP Operating Mode                 : Server
VTP Domain Name                    : CORP
```

- VLAN information is not propagated until a VTP Domain Name is specified and learned through trunked ports.

- The default settings for interfaces on the switches are to automatically trunk when cabled appropriately.

- Therefore, VTP automatically propagates the CORP VTP Domain Name to both ALSwitchA1 and ALSwitchA2.

Non-trunking ports

```
ALSwitchA1#show interfaces fastethernet 0/10 switchport
Name: Fa0/10
Switchport: Enabled
Administrative Mode: dynamic desirable
Operational Mode: down
Administrative Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
```

- Issue a **`show interfaces FastEthernet 0/10 switchport`** command on ALSwitchA1 to view the default settings on a port that is **not** connected to another switch.

- Since this port is **not** connected to another switch no trunking negotiations have taken place.

- Cisco switches use DTP (Dynamic Trunking Protocol) to negotiate trunking or non-trunking between switch ports

Non-trunking ports

```
DLSwitchA#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/6, Fa0/7, Fa0/8, Fa0/9
                                                Fa0/10, Fa0/11, Fa0/12, Fa0/13
                                                Fa0/14, Fa0/15, Fa0/16, Fa0/17
                                                Fa0/18, Fa0/19, Fa0/20, Fa0/21
                                                Fa0/22, Fa0/23, Fa0/24, Gi0/1
```
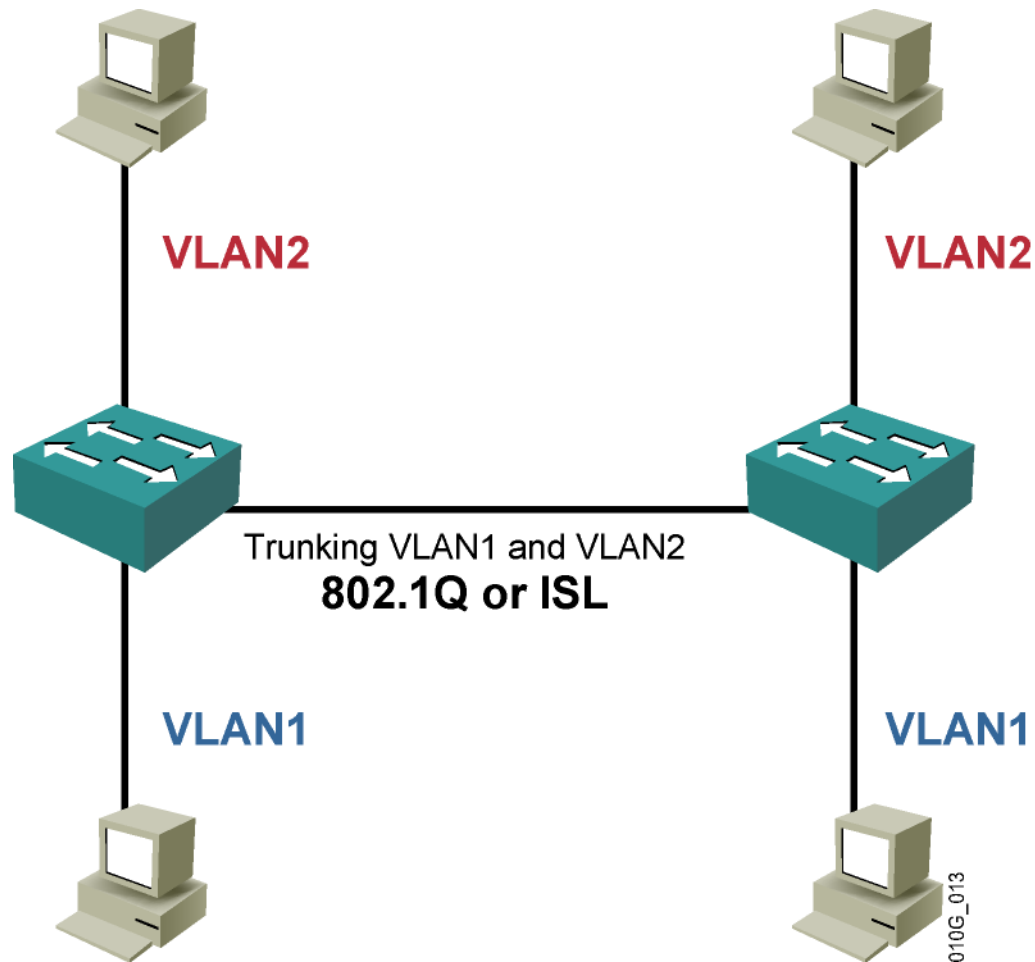
- By default, on switch ports are assigned to VLAN 1.
- Notice that the trunking interfaces FastEthernet 0/1 through 0/5 on DLSwitchA are not in VLAN 1.
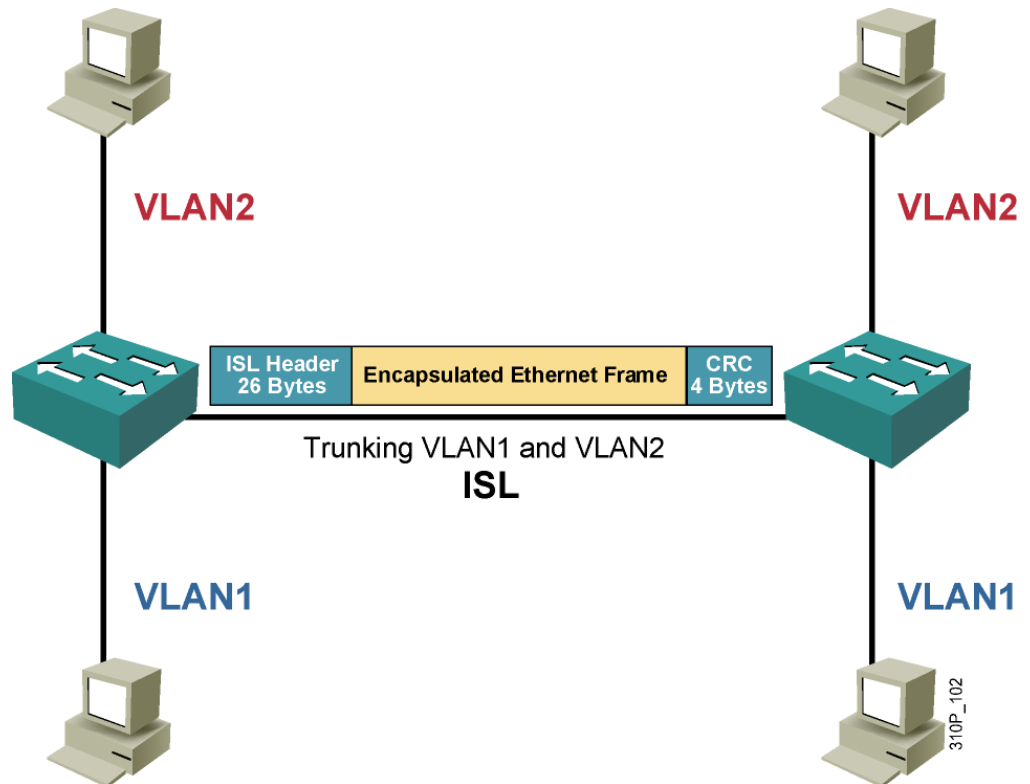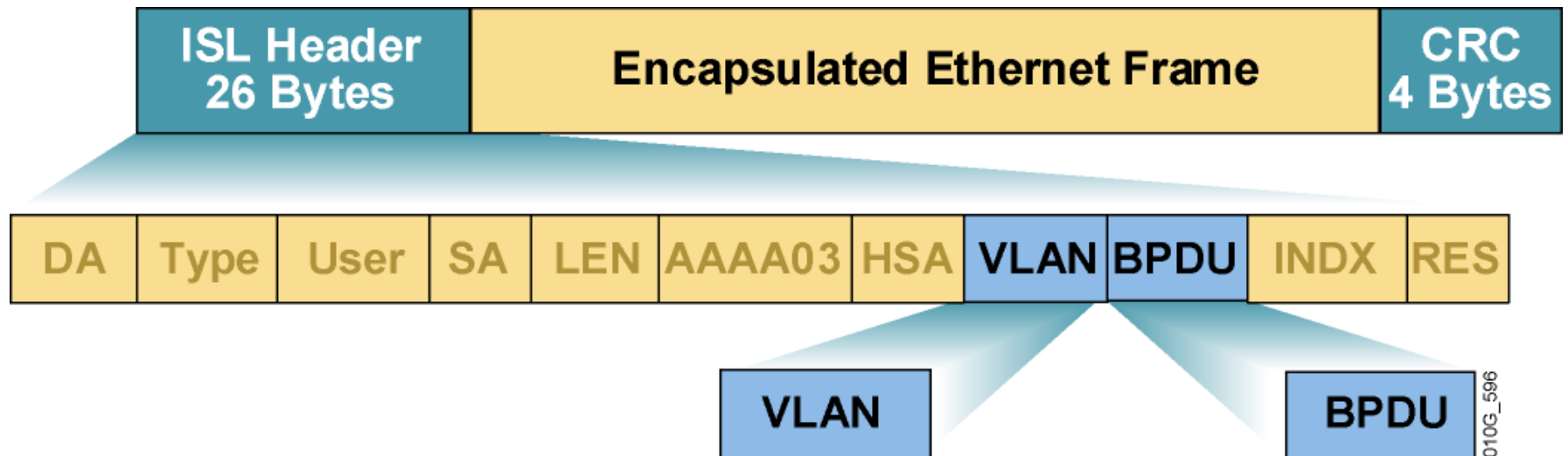
Trunking

VLAN Trunking

VLAN2

VLAN2

Trunking VLAN1 and VLAN2
802.1Q or ISL

VLAN1

VLAN1

010G_013
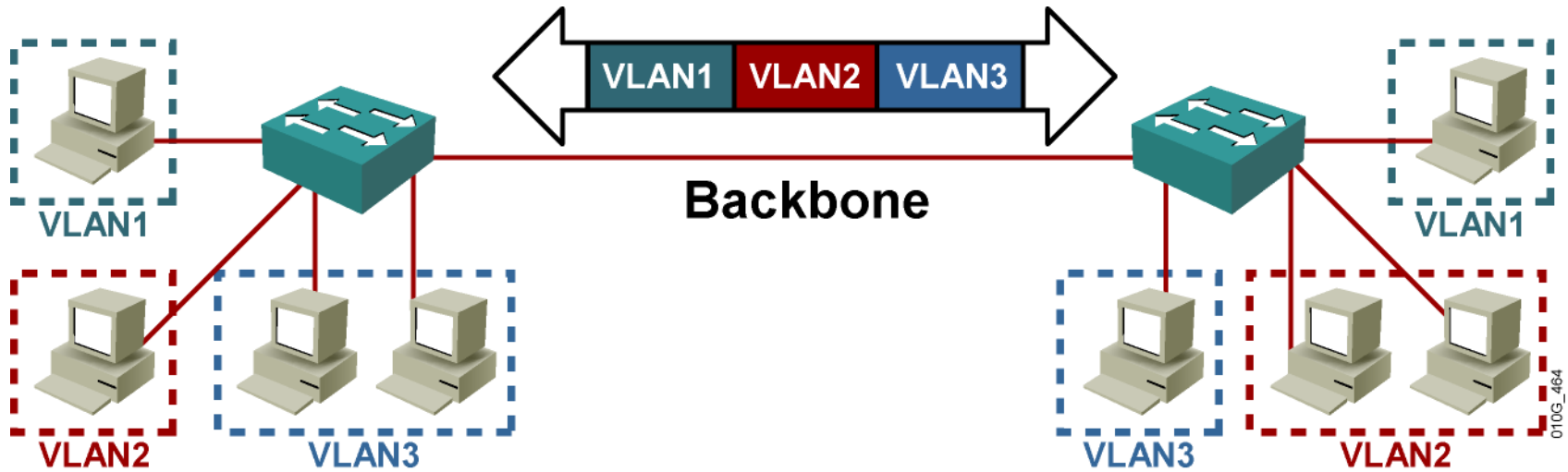
Comparing ISL and 802.1Q

ISL	802.1Q
Proprietary	Nonproprietary
Encapsulated	Tagged
Protocol independent	Protocol dependent
Encapsulates the old frame in a new frame	Adds a field to the frame header

Trunking with ISL

- Is a Cisco proprietary protocol
- Supports PVST
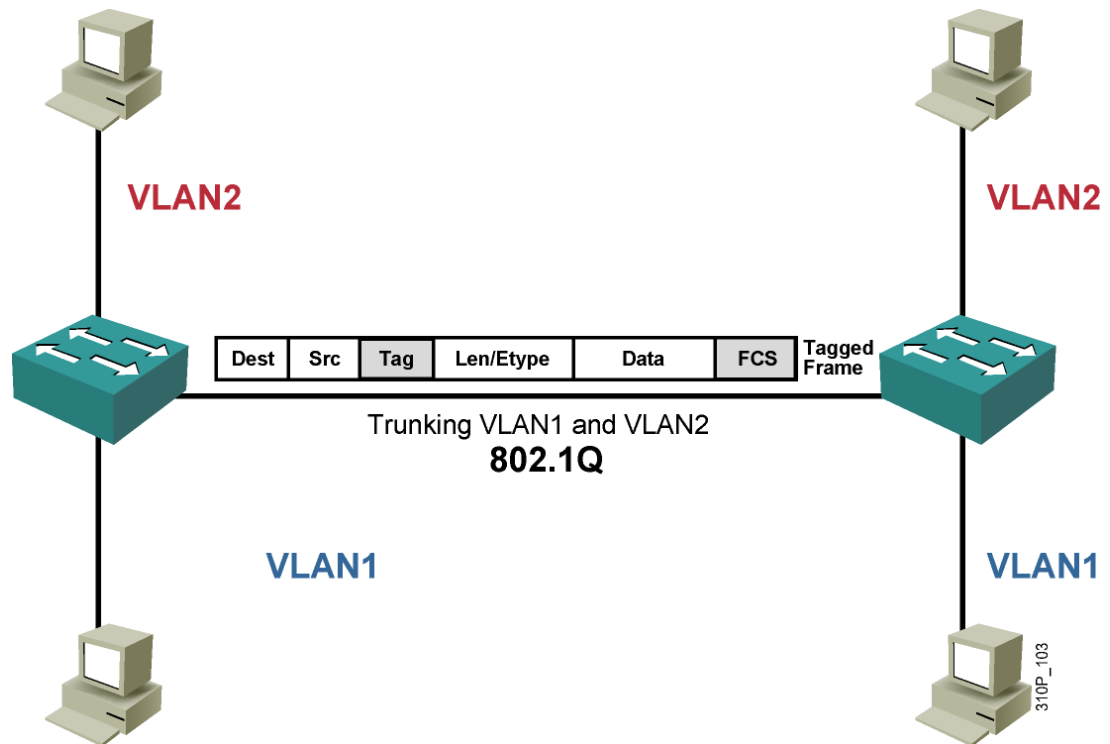- Uses an encapsulation process
- Does not modify the original frame

VLAN2   VLAN2

| ISL Header 26 Bytes | Encapsulated Ethernet Frame | CRC 4 Bytes |

Trunking VLAN1 and VLAN2
ISL

VLAN1   VLAN1

310P_102

ISL Encapsulation

ISL Header 26 Bytes	Encapsulated Ethernet Frame	CRC 4 Bytes

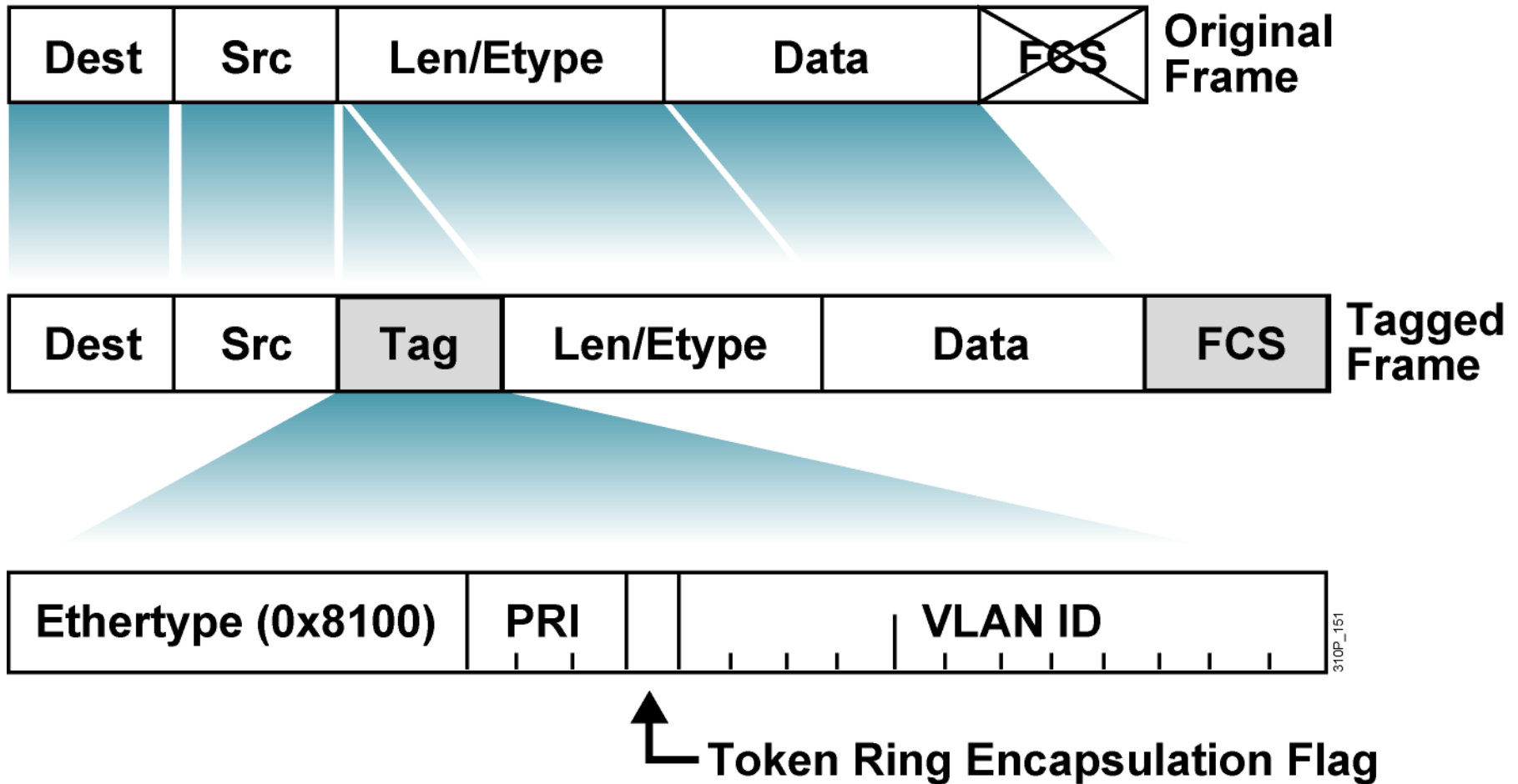| DA	Type	User	SA	LEN	AAAA03	HSA	VLAN	BPDU	INDX	RES

VLAN

BPDU

010G_596

Trunking with 802.1Q

- An IEEE standard
- Adds a 4-byte tag to the original frame
- Additional tag includes a priority field
- Does not tag frames that belong to the native VLAN
- Supports Cisco IP Telephony

VLAN2

VLAN2

| Dest | Src | Tag | Len/Etype | Data | FCS | Tagged Frame |

Trunking VLAN1 and VLAN2
802.1Q

VLAN1

VLAN1

310P_103

The 802.1Q Tagging Process

| Dest | Src | Len/Etype | Data | ~~FCS~~ | Original Frame |

| Dest | Src | Tag | Len/Etype | Data | FCS | Tagged Frame |

| Ethertype (0x8100) | PRI | | VLAN ID |

310P_151

↑
└ Token Ring Encapsulation Flag

Trunking ports

```
DLSwitchA#show interface fastethernet 0/2 switchport
Name: Fa0/2
Switchport: Enabled
Administrative Mode: dynamic desirable
Operational Mode: trunk
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
```

- Issue a **show interfaces FastEthernet 0/2 switchport** command on DLSwitchA and on ALSwitchA1 to view the default settings on a port that is connected to another switch.

- The trunking-related items are highlighted.

- Since this port is connected to another switch trunking negotiations have taken place using DTP (Dynamic Trunking Protocol) and the ports are trunking.

show interface trunk

```
DLSwitchA#show interfaces trunk

Port       Mode          Encapsulation    Status        Native vlan
Fa0/1      desirable     n-802.1q         trunking      1
Fa0/2      desirable     n-802.1q         trunking      1
Fa0/3      desirable     n-802.1q         trunking      1
Fa0/4      desirable     n-802.1q         trunking      1
Fa0/5      desirable     n-isl            trunking      1
Gi0/2      desirable     n-802.1q         trunking      1


ALSwitchA1#show interfaces trunk

Port       Mode          Encapsulation    Status        Native vlan
Fa0/1      desirable     802.1q           trunking      1
Fa0/2      desirable     802.1q           trunking      1
Fa0/3      desirable     802.1q           trunking      1
Fa0/4      desirable     802.1q           trunking      1
Fa0/5      desirable     802.1q           trunking      1
Gi0/1      desirable     802.1q           trunking      1
Gi0/2      desirable     802.1q           trunking      1
```

show running-config

```
DLSwitchA#show running-config
!
<Output omitted>
!
interface FastEthernet0/1
 no ip address
!
interface FastEthernet0/2
 no ip address
!
```

- The trunk status of the respective trunk ports will appear in the output of the **show running-config** command only if the ports have been manually configured as trunk ports. (later)

VTP Client Mode

```
ALSwitchA1(config)#vtp mode client
Setting device to VTP CLIENT mode.


ALSwitchA2(config)#vtp mode client
Setting device to VTP CLIENT mode.


ALSwitchA1#show vtp status
VTP Version                          : 2
Configuration Revision               : 0
Maximum VLANs supported locally      : 250
Number of existing VLANs             : 5
VTP Operating Mode                   : Client
VTP Domain Name                      : CORP
```

- More than one switch can exist in the VTP Server mode.
- The VTP mode of ALSwitchA1 and ALSwitchA2 will be changed to the VTP Client mode.

Configuring VLANs

```
DLSwitchA#vlan database
DLSwitchA(vlan)#vlan 10 name Accounting
VLAN 10 added:
    Name: Accounting
DLSwitchA(vlan)#vlan 20 name Marketing
VLAN 20 added:
    Name: Marketing
DLSwitchA(vlan)#?
VLAN database editing buffer manipulation commands:
  abort  Exit mode without applying the changes
  apply  Apply current changes and bump revision number
  exit   Apply changes, bump revision number, and exit mode
  no     Negate a command or set its defaults
  reset  Abandon current changes and reread current database
  show   Show database information
  vlan   Add, delete, or modify values associated with a single VLAN
  vtp    Perform VTP administrative functions.


DLSwitchA(vlan)#exit
APPLY completed.
Exiting....
DLSwitchA#
```

- Most IOS commands take affect immediately after applying the command. Commands entered in vlan database mode to not take affect until this mode is properly ended.

VTP propagating VLAN information

```
DLSwitchA#show vtp status
VTP Version                    : 2
Configuration Revision         : 1
Maximum VLANs supported locally : 1005
Number of existing VLANs       : 7
VTP Operating Mode             : Server
VTP Domain Name                : CORP
<Output omitted>


ALSwitchA1#show vtp status
VTP Version                    : 2
Configuration Revision         : 1
Maximum VLANs supported locally : 250
Number of existing VLANs       : 7
VTP Operating Mode             : Client
VTP Domain Name                : CORP
```

- The Configuration Revision number will now be increased from zero to one as shown in the following sample output for DLSwitchA.
- Use `show vlan` to verify the VLAN names will now appear on the Client switches.

Assigning Ports to VLANs

DLSwitchA	**ALSwitchA1**	**ALSwitchA2**
VLAN 1: 6-10, 18-24	VLAN 1: 6-10, 18-24	VLAN 1: 6-10, 18-24
VLAN 10: 11-15	VLAN 10: 11-15	VLAN 10: 11-15
VLAN 20: 16,17	VLAN 20: 16,17	VLAN 20: 16,17

- By default all ports are assigned to the default VLAN, VLAN 1.
- There is no need to assign ports to VLAN 1 since that is the default VLAN to which the ports are assigned.
- Configure all of the non-trunking ports to access unconditionally.
- VLAN 1 is the default VLAN, so only the access mode needs to be configured on those ports.

Assigning Ports to VLANs

```
DLSwitchA(config)#interface fastethernet 0/6
DLSwitchA(config-if)#switchport mode ?
  access        Set trunking mode to ACCESS unconditionally
  dot1q-tunnel  Set trunking mode to DOT1Q TUNNEL unconditionally
  dynamic       Set trunking mode to dynamically negotiate access or trunk
   mode
  trunk         Set trunking mode to TRUNK unconditionally

DLSwitchA(config-if)#switchport mode access
DLSwitchA(config-if)#exit

DLSwitchA(config)#interface range fa 0/7 - 10
DLSwitchA(config-if-range)#switchport mode access

DLSwitchA(config)#interface range fa 0/18 - 24
DLSwitchA(config-if-range)#switchport mode access
```

- Configuring VLAN 1 ports
- Only `switchport mode access` command needs to be used

Assigning Ports to VLANs

```
DLSwitchA(config)#interface range fa 0/11 - 15
DLSwitchA(config-if-range)#switchport mode access
DLSwitchA(config-if-range)#switchport access vlan 10

DLSwitchA(config)#interface range fa 0/16 - 17
DLSwitchA(config-if-range)#switchport mode access
DLSwitchA(config-if-range)#switchport access vlan 20
```

- Both the **switchport mode access** command and `switchport access vlan n` must be used for non-VLAN 1 ports.

Why the switchport mode access command?

```
ALSwitchA2(config)#interface range fa 0/11 - 15
ALSwitchA2(config-if-range)#switchport access vlan 10
ALSwitchA2(config-if-range)#end


ALSwitchA2#show interface fa 0/11 switchport
Name: Fa0/11
Switchport: Enabled
Administrative Mode: dynamic desirable
Operational Mode: down
Administrative Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 10 (Accounting)
Trunking Native Mode VLAN: 1 (default)
Voice VLAN: none
```

- Notice that these interfaces will still try to negotiate trunking

Why the switchport mode access command?

```
ALSwitchA2(config)#interface range fa 0/11 - 15
ALSwitchA2(config-if-range)#switchport mode access

ALSwitchA2#show interface fa 0/11 switchport
07:18:54: %SYS-5-CONFIG_I: Configured from console by console
ALSwitchA2#show interface fa 0/11 switchport
Name: Fa0/11
Switchport: Enabled
Administrative Mode: static access
Operational Mode: down
Administrative Trunking Encapsulation: dot1q
Negotiation of Trunking: Off
Access Mode VLAN: 10 (Accounting)
```

- Now configure the range of interfaces for permanent nontrunking, access mode
- Notice that negotiation of trunking has been turned off and that this port will only be a non-trunking access port.

Verify configurations

```
DLSwitchA#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- ------------------------------
1    default                          active    Fa0/6, Fa0/7, Fa0/8, Fa0/9
                                                Fa0/10, Fa0/18, Fa0/19, Fa0/20
                                                Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                                Gi0/1
10   Accounting                       active    Fa0/11, Fa0/12, Fa0/13, Fa0/14
                                                Fa0/15
20   Marketing                        active    Fa0/16, Fa0/17
```

- The `show vlan` command displays the name of VLAN 10 and VLAN 20 as Accounting and Marketing on ALSwitchA1 or ALSwitchA2.
- Even though these VLAN names were not created on these switches, VTP propagated this information.
- VTP would propagate this information, these VLANs and their names would be present even if there were no interfaces assigned to these VLANs on these switches.

VLAN names and numbers propagated via VTP

```
ALSwitchA1#show vtp status
VTP Version                      : 2
Configuration Revision           : 1
Maximum VLANs supported locally : 250
Number of existing VLANs         : 7
VTP Operating Mode               : Client
VTP Domain Name                  : CORP
```
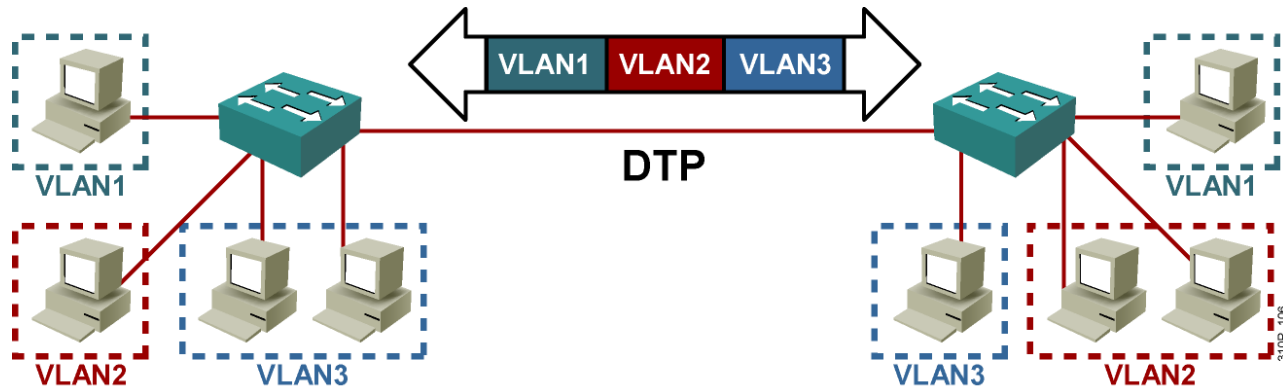
Configuring Trunking Manually

- By default, interfaces on the 2950T-24-EI and 3550-24-EMI switches should automatically trunk when cabled and propagate VLAN information after a domain name is entered in a VTP server switch. (See information regarding DTP, Dynamic Trunking Protocol.)

- The 3550 switch supports three Ethernet trunk encapsulation types:
  1. Cisco proprietary InterSwitch Link protocol (ISL)
  2. IEEE 802.1Q
  3. Negotiate or default – This specifies that the interface negotiates with the neighboring interface to become an ISL, which is preferred, or 802.1Q trunk. This depends on the configuration and capabilities of the neighboring interface.

- The 2950T switch does not support ISL.

- Since the 2950T switch only supports IEEE 802.1Q, the 3550 switch automatically negotiates that encapsulation type through the trunk connection.

- The Negotiation of Trunking is activated by default for both switches. As soon as there is a cable connection, the switches establish a trunk link.

VLAN Ranges

VLAN Range	Use
0, 4095	Reserved for system use only
1	Cisco default
2–1001	For Ethernet VLANs
1002–1005	Cisco defaults for FDDI and Token Ring
1006–4094	Ethernet VLANs only, unusable on specific legacy platforms

Trunking Configuration Commands

- Trunks can be configured statically or via DTP.
- DTP provides the ability to negotiate the trunking method.

- Configuring a Trunk
  - **switchport trunk**
  - **switchport mode**
  - **switchport nonegotiate**

Switchport Mode Interactions

	Dynamic Auto	Dynamic Desirable	Trunk	Access
Dynamic Auto	Access	Trunk	Trunk	Access
Dynamic Desirable	Trunk	Trunk	Trunk	Access
Trunk	Trunk	Trunk	Trunk	Not recommended
Access	Access	Access	Not recommended	Access

Note: Table assumes DTP is enabled at both ends.
- `show dtp interface` **– to determine current setting**

Configuring Trunking Manually

```
DLSwitchA(config)#interface range fastethernet 0/1 - 4, gigabitethernet 0/2
DLSwitchA(config-if-range)#switchport mode trunk
Command rejected: An interface whose trunk encapsulation is "Auto" can not be
    configured to "trunk" mode.
DLSwitchA(config-if-range)#switchport trunk encapsulation dot1q
DLSwitchA(config-if-range)#switchport mode trunk
```

- On switches that support multiple trunking encapsulations (802.1Q and ISL), you must first configure the trunking encapsulation before setting the interface to trunk mode.

- The switchport trunk encapsulation command must be configured before the switchport mode trunk.

Configuring Trunking Manually

```
ALSwitchA1(config)#inter range fa 0/1 - 2, fa 0/5
ALSwitchA1(config-if-range)#switchport mode trunk


ALSwitchA1(config)#inter gig 0/2
ALSwitchA1(config-if)#switchport mode trunk


DLSwitchA#show interfaces trunk


Port       Mode           Encapsulation   Status        Native vlan
Fa0/1      on             802.1q          trunking      1
Fa0/2      on             802.1q          trunking      1
Fa0/3      on             802.1q          trunking      1
Fa0/4      on             802.1q          trunking      1
Fa0/5      desirable      n-isl           trunking      1
Gi0/2      on             802.1q          trunking      1
```

- The 2950T switch does not support IEEE 802.1Q, so there is no encapsulation option.
- Use the show interface trunk command and notice that the DTP (Dynamic Trunking Protocol) **mode** has changed from "desirable" to "on".

Configuring Trunking Manually

```
DLSwitchA#show run
<Output omitted>
interface FastEthernet0/1
 switchport trunk encapsulation dot1q
 switchport mode trunk
 no ip address!
```

- Notice that the manual trunk commands are displayed in the running-config

Native VLAN

- A topic that causes considerable confusion is the native VLAN.

- "802.1Q is the IEEE standard for tagging frames on a trunk and supports up to 4096 VLANs. In 802.1Q, the trunking device inserts a 4-byte tag into the original frame and recomputes the frame check sequence (FCS) before the device sends the frame over the trunk link. At the receiving end, the tag is removed and the frame is forwarded to the assigned VLAN. **802.1Q does not tag frames on the native VLAN.** It tags all other frames that are transmitted and received on the trunk. When you configure an 802.1Q trunk, you must make sure that you configure the same native VLAN on both sides of the trunk." *Inter-Switch Link and IEEE 802.1Q Frame Format, Cisco Systems, Document ID: 17056*

- By default, frames from VLAN 1 belong to the native VLAN, and are carried across the trunk untagged.

- Frames from the native VLAN, VLAN 1, are carried across this trunk link untagged.

Native VLAN

- The IEEE committee that defined 802.1Q decided that because of backward compatibility it was desirable to support the so-called native VLAN, that is to say, a VLAN that is not associated explicitly to any tag on an 802.1Q link.

- This VLAN is implicitly used for all the untagged traffic received on an 802.1Q capable port.

- This capability is desirable because it allows 802.1Q capable ports to talk to old 802.3 ports directly by sending and receiving untagged traffic.

- VLAN 1 is the Native VLAN by default so it is not necessary to configure it. VLANs other than VLAN 1 may be designated as the Native VLAN.

- However, the Native VLAN must be the same on trunked switches in 802.1Q trunking.

- In 802.1Q trunking, all VLAN packets are tagged on the trunk link to indicate the VLAN to which they belong.

- The Native VLAN packets are sent untagged on the trunk link.

Native VLAN

```
DLSwitchA(config)#inter range fastethernet 0/1 - 4, gigabitethernet 0/2
DLSwitchA(config-if-range)#switchport trunk native vlan 1
```

- Although trunking has been automatically negotiated and established, the interfaces and native VLAN should be configured manually.
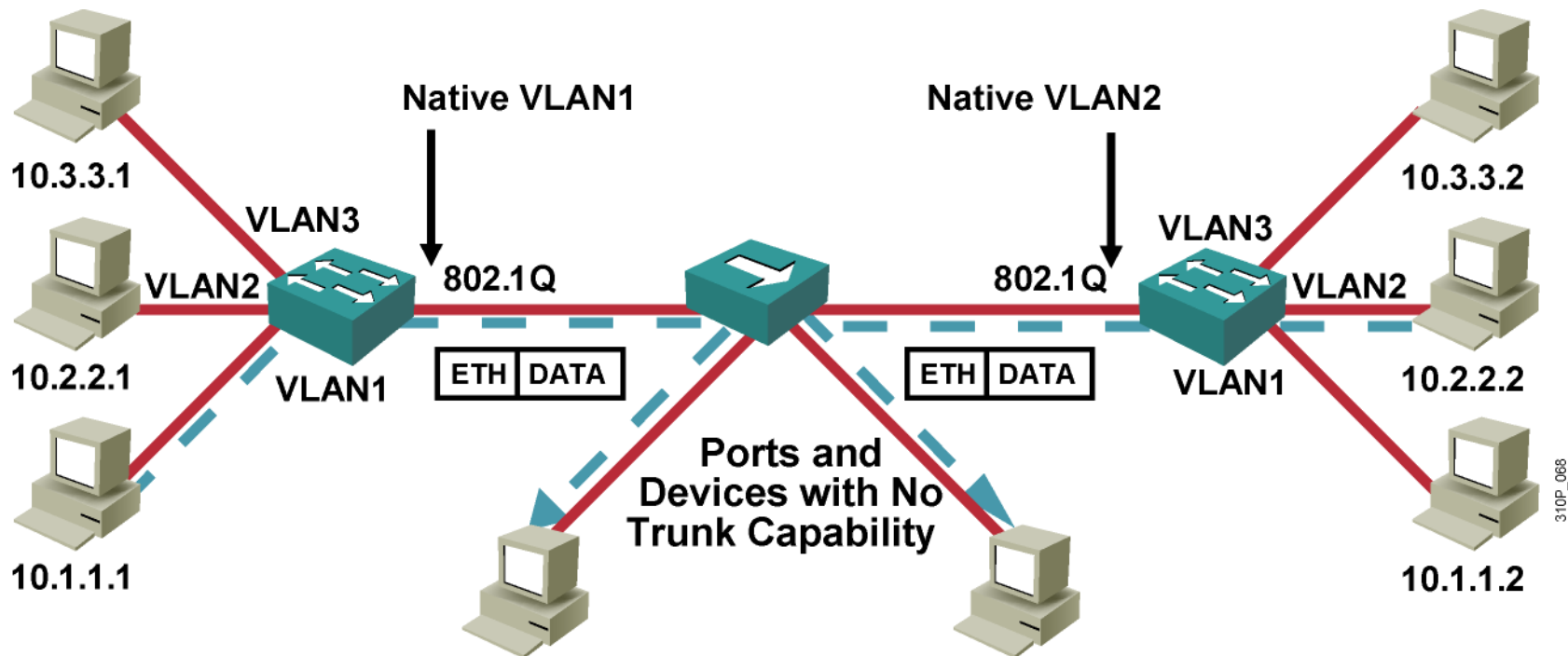
802.1Q Native VLAN

Native VLAN frames will be sent untagged on an 802.1Q trunk.

Frames received untagged on an 802.1Q trunk port will be forwarded to the native VLAN.

10.3.3.1

VLAN3

VLAN2

802.1Q

ETH DATA

802.1Q

ETH DATA

VLAN3

10.3.3.2

VLAN2

10.2.2.1

VLAN1

VLAN1

10.2.2.2

10.1.1.1

Ports and Devices with no Trunk Capability

10.1.1.2

— — ➤ VLAN1 untagged traffic (native VLAN)

310P_104

Native VLAN frames are carried over the trunk link untagged.

Troubleshooting VLANs

Issues with 802.1Q Native VLAN

- Native VLAN frames are carried over the trunk link untagged.
- A native VLAN mismatch will merge traffic between VLANs.

802.1Q Native VLAN Considerations

- Native VLAN must match at ends of trunk otherwise frames will 'leak' from one VLAN to another.

- By default the native VLAN will be VLAN1.
  - Avoid using VLAN 1 for management purposes.

- Eliminate native VLANs from 802.1Q trunks by making the native VLAN an 'unused' VLAN.
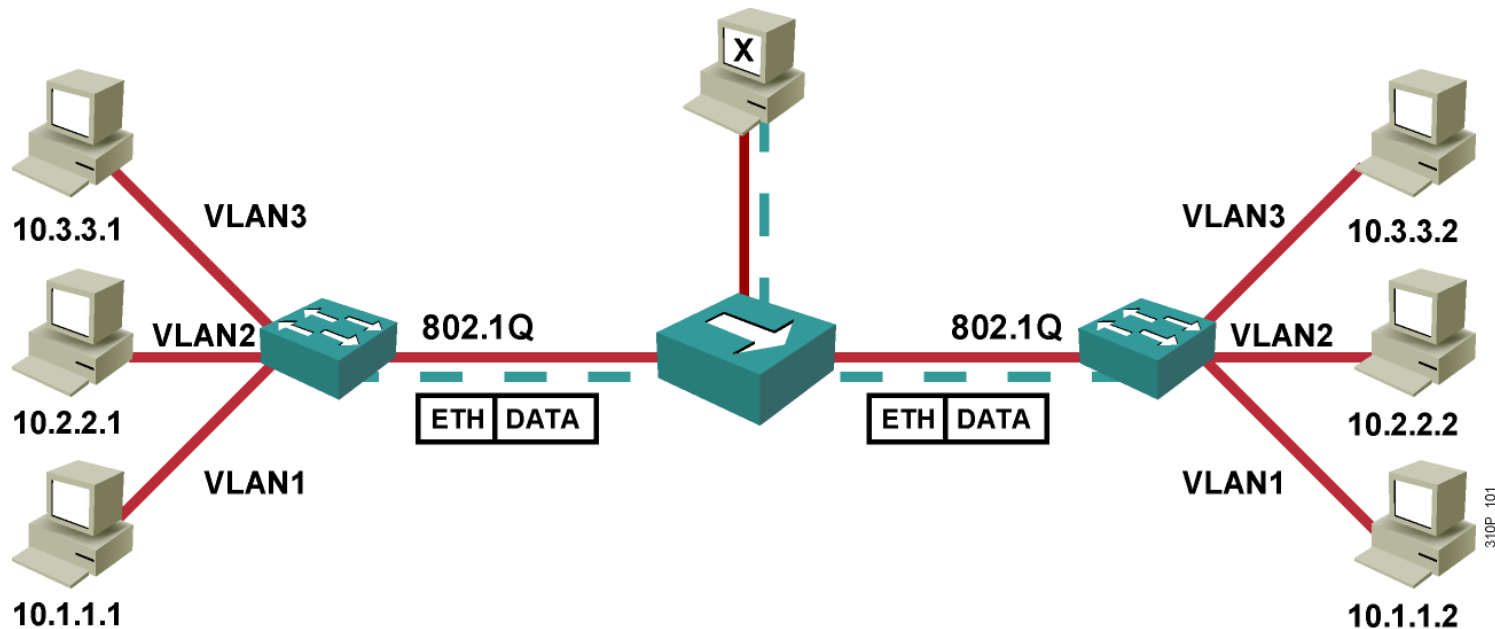
Explaining Trunk Link Problems

- Trunks can be configured statically or autonegotiated with DTP.
- For trunking to be autonegotiated, the switches must be in the same VTP domain.
- Some trunk configuration combinations will successfully configure a trunk, some will not.
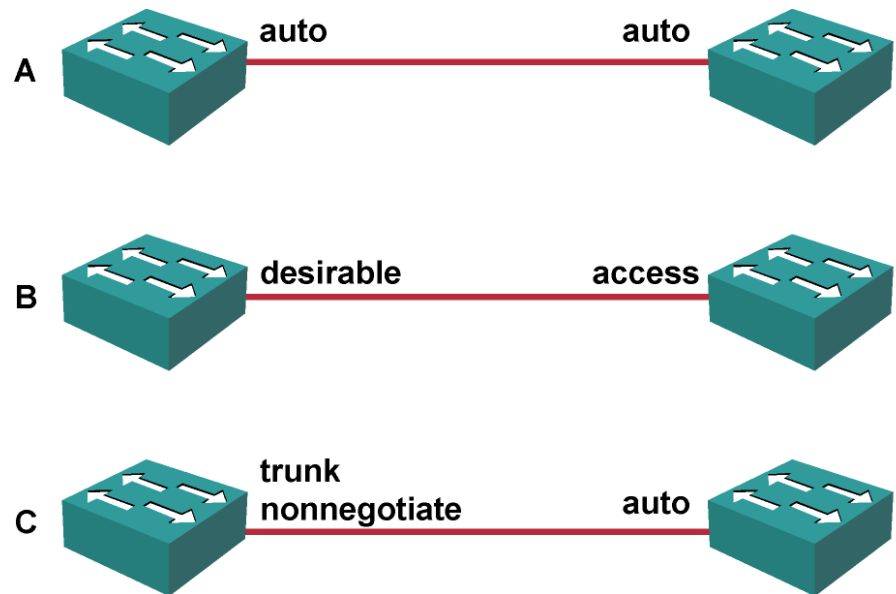
- Will any of the above combinations result in an operational trunk?

Resolving Trunk Link Problems

- When using DTP, ensure that both ends of the link are in the same VTP domain.

- Ensure that the trunk encapsulation type configured on both ends of the link is valid.

- DTP should be turned off on links where trunking is not required.

- Best practice is to configure **trunk** and **nonegotiate** where trunks are required.

trunk
nonnegotiate

trunk
nonnegotiate

←— No DTP —→

310P_084

Common Problems with VTP Configuration

- Updates not received as expected
  - VTP domain and password must match.

- Missing VLANs
  - Configuration has been overwritten by another VTP device.

- Too many VLANs
  - Consider making VTP domain smaller.
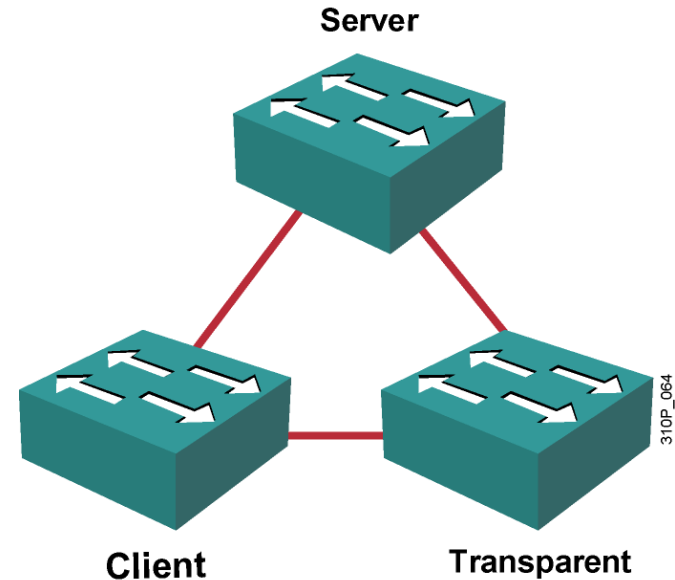
Server

Client   **Transparent**

310P_064

Example of New Switch Overwriting an Existing VTP Domain

New switch not connected

VTP Version : 2
Configuration Revision : 2
Maximum VLANs supported locally : 1005
Number of existing VLANs : 7
VTP Operating Mode : Client
VTP Domain Name : building1

VTP Version : 2
Configuration Revision : 1
Maximum VLANs supported locally : 1005
Number of existing VLANs : 6
**VTP Operating Mode : Server**
VTP Domain Name : building1

config#

New Switch

310P_120
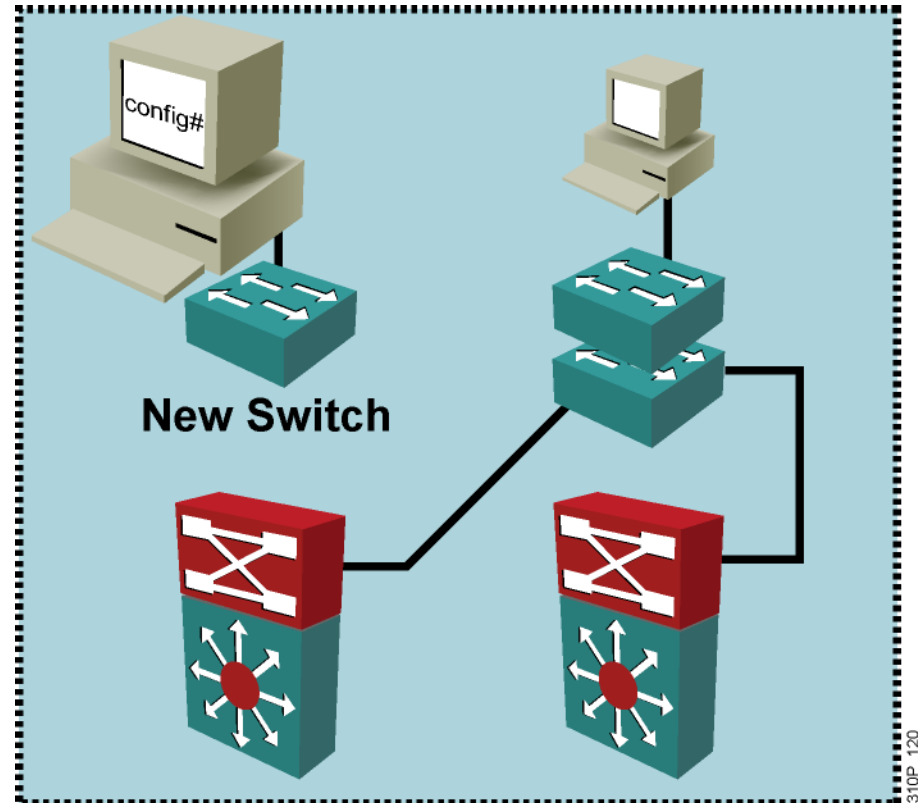
Example of New Switch Overwriting an Existing VTP Domain (cont.)

New switch connected

```
VTP Version                    : 2
Configuration Revision         : 2
Maximum VLANs supported locally : 1005
Number of existing VLANs       : 7
VTP Operating Mode             : Client
VTP Domain Name                : building1
```

```
VTP Version                    : 2
Configuration Revision         : 2
Maximum VLANs supported locally : 1005
Number of existing VLANs       : 7
VTP Operating Mode             : Server
VTP Domain Name                : building1
```


config#

New Switch

310P_121
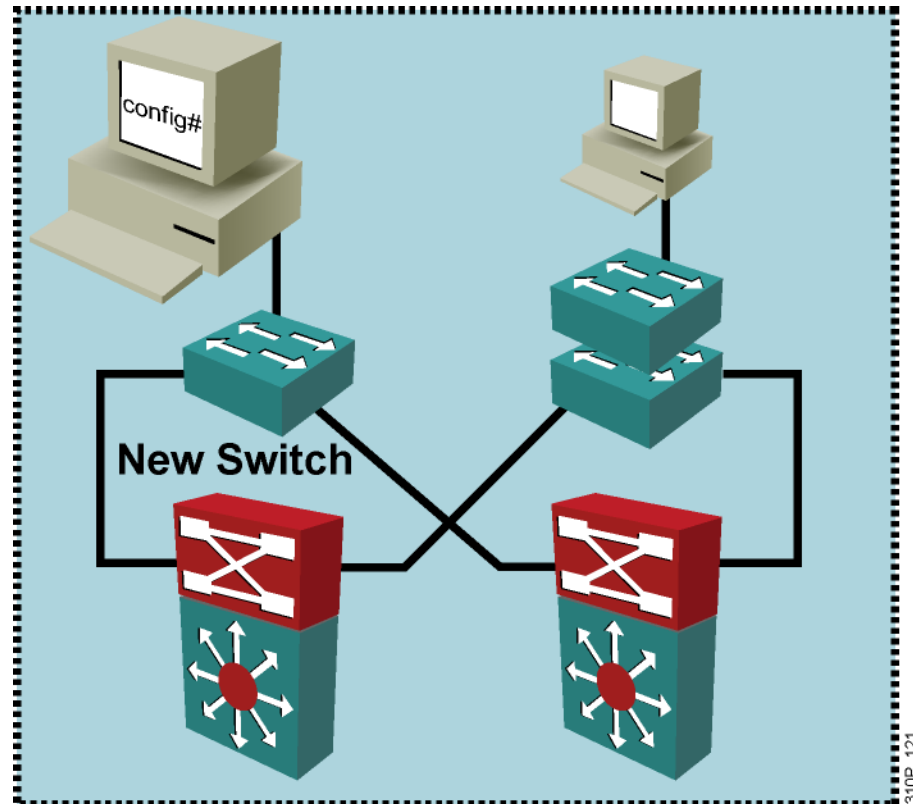
Implementing VTP in the Enterprise Composite Network Model

- Plan VTP domain boundaries.

- Have only one or two VTP servers.

- Configure a VTP password.

- Manually configure the VTP domain name on all devices.

- When setting up a new domain
  - Configure VTP client switches first so that they participate passively

- When cleaning up an existing VTP domain
  - Configure passwords on servers first because clients may need to maintain current VLAN information until the server is verified as complete.

Summary

- 802.1Q native VLAN can cause security issues.

- Configure the native VLAN to be an 'unused' VLAN.

- Some trunk link configuration combinations can result in problems on the link.

- Best practice is to configure trunks statically rather than with DTP.

- Misconfiguration of VTP can give unexpected results.

- Make only one or two VTP servers; keep the remainder as clients.